

## **Global properties of relativistic heavy-ion collisions proved by PHENIX**

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In the initial five years of operations, experiments at the Relativistic Heavy Ion Collider (RHIC) have revealed that Au+Au central collisions at  $\sqrt{s_{NN}} = 200$  GeV create a strongly coupled/interacting quark-gluon-plasma (sQGP) state that is almost opaque to jets created in the matter. This picture has been characterized by hard physics observables such as nuclear modification factors, 2-(3-)particle correlations, and anisotropic momentum flow patterns ( $v_2$  flow) for high transverse momentum ( $p_T$ ) particles. Despite of the successful interpretation of how dense the matter is, there remain open questions with respect to the space-time evolution, e.g. how fast the extremely hot-and-dense matter thermalizes and freezes-out, and the nature of the phase transition that occurs. Although the global properties of relativistic heavy-ion collisions at RHIC energies have yet to be described very well by any theoretical model, we have measured many soft physics observables such as single spectra, event-by-event fluctuations, Bose-Einstein correlations (aka HBT) that may elucidate the answers to these questions.

In this talk, we present recent PHENIX results regarding soft physics observables including  $v_2$  flows,  $p_T$  spectra, HBT gaussian radii and source distributions, and multiplicity fluctuations of charged hadrons measured at low transverse momentum ( $p_T < \sim 2$  GeV/c) and mid-rapidity ( $|\eta| < 0.35$ ). We focus on results observed in Au+Au collision at  $\sqrt{s_{NN}} = 200$  GeV, but results from Au+Au at 63 GeV and Cu+Cu at 63 and 200 GeV will also be presented. In addition, comparisons with results from recent hydrodynamics transport calculations will be presented to provide more detailed insight into the properties of the space-time evolution such as the order of the phase transition and collective dynamics of the dense matter.

### **References**

- [1] K. Adcox *et al.*, Nuclear Physics A Volume 757, Issues 1-2 , 8 August 2005, Pages 184-283.